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CHARACTER SETS FOR OPTICAL  
CHARACTER RECOGNITION (OCR)

CATEGORY: HARDWARE STANDARD

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CATEGORY: CHARACTER RECOGNITION

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**U.S. DEPARTMENT OF COMMERCE, Malcolm Baldrige, Secretary**  
**NATIONAL BUREAU OF STANDARDS, Ernest Ambler, Director**

## **Foreword**

The Federal Information Processing Standards Publication Series of the National Bureau of Standards is the official publication relating to standards adopted and promulgated under the provisions of Public Law 89-306 (Brooks Act) and under Part 6 of Title 15, Code of Federal Regulations. These legislative and executive mandates have given the Secretary of Commerce important responsibilities for improving the utilization and management of computers and automatic data processing in the Federal Government. To carry out the Secretary's responsibilities, the NBS, through its Institute for Computer Sciences and Technology, provides leadership, technical guidance, and coordination of Government efforts in the development of guidelines and standards in these areas.

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James H. Burrows, *Director*  
Institute for Computer Sciences and Technology

## **Abstract**

This Federal Information Processing Standard supersedes FIPS PUB 32 and provides the description, scope, and identification of sets of graphic shapes to be used in applying Optical Character Recognition (OCR) in Federal Government agencies. American National Standards X3.2-1970 (R1976), X3.17-1981, and X3.49-1975 (R1982) are incorporated by reference. They supply all of the required dimensions, application rules, and reference sources.

A set of graphic shapes for special applications related to Magnetic Ink Character Reading (MICR) is provided and is designated MICR Characters Read Optically. This is a unique requirement for certain Federal Government agencies that has not yet been addressed by an American National Standard. Its principal function is to provide the different tolerances involved in optical character reading practice from certain requirements usually needed in magnetic ink reading practice.

Key words: character shapes; data entry; Federal Information Processing Standard; graphic shapes; magnetic ink characters; MICR; MICR Read Optically; OCR; optical character recognition.

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## Federal Information Processing Standards Publication 32-1

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Announcing the Standard for

### CHARACTER SETS FOR OPTICAL CHARACTER RECOGNITION (OCR)

Federal Information Processing Standards Publications are issued by the National Bureau of Standards pursuant to section 111(f)(2) of the Federal Property and Administrative Services Act of 1949, as amended, Public Law 89-306 (79 Stat. 1127), Executive Order 11717 (38 FR 12315, dated May 11, 1973) and Part 6 of Title 15 Code of Federal Regulations (CFR).

**Name of Standard.** Character Sets for Optical Character Recognition (OCR) (FIPS PUB 32-1).

**Category of Standard.** Hardware Standard, Character Recognition.

**Explanation.** This standard prescribes standard sets of printed graphic shapes and sizes to be used in Optical Character Recognition (OCR) systems employed by Federal agencies. This revised standard supersedes FIPS 32 in its entirety.

**Approving Authority.** Secretary of Commerce.

**Maintenance Agency.** U.S. Department of Commerce, National Bureau of Standards (Institute for Computer Sciences and Technology).

**Cross Index.** Standards required to implement this FIPS PUB:

- a. ANS X3.2-1970 (R1976), *American National Standard for Print Specifications for Magnetic Ink Character Recognition (MICR E-13B)*.
- b. ANS X3.17-1981, *American National Standard for Character Set for Optical Character Recognition (OCR-A)*.
- c. ANS X3.49-1975 (R1982), *American National Standard Character Set for Optical Character Recognition (OCR-B)*.

#### Related Documents.

- a. Federal Information Processing Standards Publication (FIPS PUB) 89, *Optical Character Recognition (OCR) Character Positioning*.
- b. Federal Information Processing Standards Publication (FIPS PUB) 90, *Guideline for Optical Character Recognition (OCR) Print Quality*.
- c. Federal Information Processing Standards Publication (FIPS PUB) 85, *Optical Character Recognition (OCR) Inks*.
- d. Federal Information Processing Standards Publication (FIPS PUB) 40, *Guideline for Optical Character Recognition Forms*.
- e. Federal Information Processing Standards Publication (FIPS PUB) 1-1, *Code for Information Interchange*.
- f. Federal Information Processing Standards Publication (FIPS PUB) 15, *Subsets of the Standard Code for Information Interchange*.
- g. American National Standard X3.93M-1981, *American National Standard for Optical Character Recognition (OCR) Character Positioning*.
- h. ANS X3.86-1980, *American National Standard for Optical Character Recognition (OCR) Inks*.
- i. ANS X3.4-1977, *American National Standard Code for Information Interchange (ASCII)*.

**Applicability.** This standard is applicable to Optical Character Recognition (OCR) systems utilizing any part or all of the character sets contained herein when used in data entry systems. However, when data or information is being prepared using OCR techniques for the purposes of the

interchanging information, the appropriate graphic or control characters of FIPS PUB 1-1, *Code for Information Interchange*, or an appropriate subset as defined in FIPS PUB 15, *Subsets of the Standard Code for Information Interchange*, shall be used for such interchange.

**Specifications.** This standard specifies the shapes and sizes of printed characters designed to be automatically recognized by optical means. These characters are contained in three sets, designated as OCR-A, OCR-B, and MICR E-13B. MICR E-13B is intended for automatic recognition by magnetic means. Optical recognition techniques applied to MICR E-13B characters under certain conditions can achieve higher recognition rates and can tolerate greater character skew. The number of characters to be employed and the sets from which they are selected shall be determined by the requirements of each application.

This standard adopts in whole, or that part indicated, ANSI X3.4-1977, *Character Set for Optical Character Recognition (OCR-A)*, ANSI X3.49-1977, *Print Character Set for Optical Character Recognition (OCR-B)* (with the additional requirements as explained in the Applicability section), and ANSI X3.2-1970 (R1976), *Print Specifications for Magnetic Ink Character Recognition (MICR)* (except Sections 5, 11, the Appendix, and related illustrations in X3.2-1970 (R1976)) by incorporating them into this standard by reference.

In addition, the following specifications apply to MICR E-13B:

1. Character Skew—The maximum allowable angle of rotation of MICR E-13B read optically is  $\pm 3.0$  degrees, measured from a line which is perpendicular to the average bottom edge of characters, excluding special symbols 3 and 1. Note that the American National Standard X3.2-1970 (R1976), *Print Specifications for Magnetic Ink Character Recognition*, limits the maximum character skew to  $\pm 1.5$  degrees for magnetic ink character recognition (see figure 14 of X3.2-1970 (R1976)).
2. Relationship to the American National Standard for Information Interchange (ASCII) Code Table—The encoding of the MICR E-13B numerals and their placement is in accordance with the ASCII Code Table. The placement of these and of the four special symbols is shown in table 1.

**Qualifications.** A family of related standards is required in order to describe the full set of character shapes, sizes, and performance characteristics necessary for a complete operational OCR system. This standard is a member of such a family. Other members of the family cover OCR Forms, OCR Inks, OCR Character Positioning, and OCR Print Quality (see Related Documents section).

**Special Information.** This Federal Information Processing Standard (FIPS PUB) 32-1, Character Sets for Optical Character Recognition (OCR-A) is intended to reflect revisions in the two American National Standards for OCR upon which it is based and to include a MICR character set to meet unique needs of certain Federal agencies which meet the same needs of MICR encoded financial documents.

Specific differences between the original FIPS PUB 32-1 and this version are:

- a. The inclusion of graphic shapes for 11 special characters (OCR-B), which extends the character set to accommodate the full code table of the American National Standard Code for Information Interchange, as provided in FIPS PUB 15, which adopts American National Standard X3.4-1977 except for two diacritic marks and the underscore, which are not used in OCR-A systems as stand-alone symbols.
- b. The addition of three monetary shapes and the deletion of four punctuation characters of OCR-B, as reflected in American National Standard X3.49-1977 (R1976).
- c. The inclusion of a special character set, E-13B MICR (read optically), based on the specifications of American National Standard X3.2-1970 (R1976). This is a special set normally used in conjunction with MICR installations.

**Implementation.** The earlier version of this standard (FIPS PUB 32) became effective on December 1, 1974. This revised version became effective on June 25, 1982.

All applicable equipment or services ordered on or after the date of this FIPS PUB must be in conformance with this standard unless a waiver has been obtained in accordance with the procedure described below.

Exceptions to this standard are made in the following cases:

- a. For equipment installed or on order prior to the effective date of this standard.
- b. Where procurement actions are in the solicitation phase (i.e., Requests for Proposals or Invitations for Bids have been issued) prior to the effective date of this standard.

**Waivers.** Heads of agencies may waive the provisions of the implementation schedule. Proposed waivers relating to procurement of non-conforming equipment or the use of non-conforming character sets will be coordinated in advance with the National Bureau of Standards. Letters should be addressed to the Secretary of Commerce. They should describe the nature of the Waiver and set forth the reasons therefor.

Forty-five days should be allowed for review and response by the National Bureau of Standards. The waiver is not to be effective until a reply is received from the National Bureau of Standards; however, the final decision for the granting of a waiver is a responsibility of the agency head.

**Where to Obtain Copies.** Copies of this publication are for sale by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161. (Sale of the included specifications document is by arrangement with the American National Standards Institute.) When ordering, refer to Federal Information Processing Standards Publication 32-1 (FIPS PUB 32-1), and title. Payment may be made by check, money order, purchase order, credit card, or deposit account.

$b_7$	0	0	0	0	1	1	1	1
$b_6$	0	0	1	1	0	0	1	1
$b_5$	0	1	0	1	0	1	0	1
$b_4$	$b_3$	$b_2$	$b_1$	0	1	2	3	4
0	0	0	0					0
0	0	0	1					1
0	0	1	0					2
0	0	1	1					3
0	1	0	0					4
0	1	0	1					5
0	1	1	0					6
0	1	1	1					7
1	0	0	0					8
1	0	0	1					9
1	0	1	0					10
1	0	1	1					11
1	1	0	0					12
1	1	0	1					13
1	1	1	0					14
1	1	1	1					15

Table 1. Correspondence Between MICR E-13B Characters and the ASCII Code Table.

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